

***IN THE FIGURES***

Please replace figures 1a and 1b with the enclosed replacement drawing.

## **REMARKS**

Claims 1-43 are pending in the application and are presented for reconsideration. By the foregoing amendments, claims 1, 2, 10-11, 21-22, 30-31, 35, and 40-43 are sought to be amended merely to correct formalities in the claim language. These changes do not introduce new matter, and their entry is respectfully requested. Based on the above Amendment and the following Remarks, Applicant respectfully requests that the Examiner reconsider all outstanding objections and rejections, and withdraw them.

### **Allowable Subject Matter**

The Examiner has objected to claims 2-5, 11-14, 22-25, and 31-34 as being dependent on rejected base claims. Applicant believes that the base claims should be allowable as well. Therefore, in view of the remarks below, Applicant respectfully requests that the Examiner remove the objections to these claims.

### **Objections to the Drawings**

The Examiner has objected to Figure 1a and 1b stating that the FIGs. should be designated by a legend because only that which is old is illustrated. The drawings have now been changed to expressly label Figures 1a and 1b as Prior Art. Approval of the Replacement Drawing Sheets is respectfully requested.

### **Rejections under 35 U.S.C. §103**

Claims 1, 6-9, 21, 26-29, 40 and 42 have been rejected under 35 U.S.C. §103(a) as allegedly being unpatentable over an article entitled “Nonlinear Dimensionality Reduction by Locally Linear Embedding” by Roweis, et al. in view of an article entitled “Evolutionary Pursuit and its “Application to Face Recognition” authored by Liu, et al. Claims 10, 14-20, 30, 34-39, 41 and 43 have further been rejected as allegedly being unpatentable over Roweis in view of an

article entitled “A Mathematical Programming Approach to Kernel Fisher Algorithm” authored by Mika, et al. These rejections are now traversed.

Representative claim 1 recites:

A method of representing a set of images for pattern classification, the method comprising:  
receiving data points corresponding to the set of images in an input space;  
generating a neighboring graph indicating whether the data points are neighbors;  
estimating geodesic distances between the data points based upon the neighboring graph;  
representing each of the data points by an associated feature vector corresponding to the geodesic distances to other data points; and  
applying Fisher Linear Discriminant to the feature vectors associated with the data points to obtain an optimal direction for projecting the feature vectors for pattern classification.

Claim 21 recites a system including similar claim language. Claims 10 and 30 recite a method and system similar to claims 1 and 21, but use Kernel Fisher Linear Discriminant instead of Fisher Linear Discriminant. The claimed invention provides a system and method for representing images for pattern classification. Data points corresponding to the images are received and a neighborhood graph is generated. The geodesic distances between the data points are estimated and represented by an associated feature vector. According to different embodiments, either Fisher Linear Discriminant (FLD) or Kernel Fisher Linear Discriminant (KFLD) is applied to the feature vector to obtain an optimal direction for projecting the feature vectors for pattern classification.

The claimed invention is not obvious in view of the Roweis and Liu, either alone or in combination. Roweis discloses a Local Linear Embedding (LLE) algorithm for mapping high dimensional data into a low dimensional “description space”. (Roweis, column 1, paragraph 2). Although Fig. 2 of Roweis illustrates weights  $W_{ik}$  on a line between a data point  $X_i$  and

neighboring points  $X_k$  and  $X_j$ , the weights  $W_{ik}$  do not represent an estimate of the geodesic distance between  $X_i$  and its neighbors. Instead, the weights  $W_{ik}$  are the solution to a least-squares problem and can be used to reconstruct each data point,  $X_i$  from its neighbors. (Roweis, p. 2324, col. 1-2 and col. 3 lines 1-2). Thus the feature vector of the claimed invention is distinct from any vector determined in Roweis. Rather, Roweis teaches away from a feature vector corresponding to the geodesic distances to other data points by disclosing that the LLE method “eliminates the need to estimate pairwise distances between widely separated data points.” (Roweis, p. 2323, col. 3 lines 1-5).

As the Examiner admits, Roweis does not disclose applying FLD (or KFLD) to the feature vectors associated with the data points. Instead, the Examiner relies on Liu as allegedly disclosing this limitation. However, although Liu discloses an FLD algorithm, Liu does not disclose or suggest applying FLD to a feature vector corresponding to geodesic distances to neighboring data points. Rather, Liu describes FLD as applied to a vector that is composed of a set of image classes rather than estimates of geodesic distances (Liu, Section 2.2, paragraph 1). Accordingly, the classification method in Liu teaches away from using local neighborhood information contained in the feature vectors as recited in the claimed invention. Thus, independent claims 1 and 21 are patentable over Roweis and Liu.

Similarly, although Mika discloses a KLFD technique, Mika fails to disclose or suggest applying KFLD to a feature vector corresponding to geodesic distances to neighboring data points. Therefore, independent claims 10 and 31 are patentable over Roweis and Mika for at least the same reasons as above. The dependent claims not addressed above incorporate the limitations of their respective base claims and are patentable for at least the same reasons. Applicant respectfully requests that the Examiner reconsider the rejections and withdraw them.

### **Conclusion**

Applicant has properly accommodated or addressed all of the stated grounds of objection and rejection set forth by the Examiner in the Office Action. Applicant, therefore, respectfully requests that the Examiner reconsider all presently outstanding objections and rejections and withdraw them. The Examiner is invited to telephone the undersigned representative if it is felt that an interview might be useful for any reason.

Respectfully submitted  
MING-HSUAN YANG

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By: /John T. McNelis/  
John T. McNelis  
Attorney for Applicant  
Reg. No. 37,186  
FENWICK & WEST LLP  
Silicon Valley Center  
801 California Street  
Mountain View, CA 94306  
(650) 335-7133  
[jmcnelis@fenwick.com](mailto:jmcnelis@fenwick.com)